



WELDING PROCESSES

Welding management system study
to achieve uniformity and consistency
of the characteristics of the welded joint.



In partnership with IIS
Italian Institute of Welding



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The role of welding processes in WORKMEC®

Frames for non-collapsible filter bags (filter cages) are not critically complex artifacts, but one of the most significant steps for WORKMEC's management is the search for the optimal balance between production costs-which face the ever-present international competition, but which in turn depend on meeting strict contract specifications, for example regarding dimensional characteristics-and the need to ensure contractually determined important performances.

It should be noted - unlike other welded products - that there are not minimum requirements for the filter cages specified by a product standard, neither at the European (CEN) or international (ISO) level: the apparent freedom during the design and the manufacturing stages can become, however, a dangerous double-edged sword, in case of critical issues arising from the production not clearly highlighted by the contract specifications, but that can be translated into design requirements, functional or construction of which the manufacturer may himself be called to respond, in the undesirable event of a dispute. Consequently, as there are no requirements

directly applicable to welded joints, WORKMEC has developed an internal system for the management of the welding process in order to ensure a series of minimum requirements for the performance of welded joints, the realization of which - as you can see with a visit to the factory floor, even if quick - has to be guaranteed with quite high production rates.

From the technological point of view, the welding processes in use in WORKMEC are the resistance butt-welding of the circumferential rings (sometimes carried out directly in the Busnago plant, sometimes managed by external qualified suppliers) and the cross wire welding between the rings themselves and the longitudinal wires, between the rings and the devices connecting the different sections (made with thin moulded carbon steel sheets), between the longitudinal wires and the top or the bottom of each frame.

Since each section can have - as mentioned - different geometries and a variable number of wires, Wormec manages a great variety of situations, which multiply further as a function of different diameters and of the base materials



with which they the components to be welded can be made.

To ensure the required production rates, the company is equipped with automatic lines in which the weld (between wires and rings and between wire and top / bottom, in particular) is carried out in a single stage, thanks to special multiple electrodes disposed radially respect to the section, and then configured in a star.

Thanks to the experience gained, Wormec directly manages the design of these welding lines, also equipped with a system for the control of the main parameters, designed to stop the production in case of mismatch between the values of the selected and the actual parameter, in order to guarantee an optimum degree or repeatability of the pre-qualified welding procedure during the pre-production stage. In practical terms, the activities that are directly or indirectly related with the welding processes directly pertain to the technical direction.

Once defined the design features of a filter cage and before starting the production, the procedures have been optimised during the pre-production stage, through an accurate fine-tuning of the key parameters, obviously based

on the previous experience. In this stage - without any prejudice to the importance of staff experience - a great role is played by the visual examination and by the tests carried out with the dynamometer designed and manufactured by WORKMEC for the measurement of the tensile strength of the joints.

After this preliminary stage, the preliminary Welding Procedure Specifications (pWPS) are written in accordance with the European standard EN ISO 15609-5, with special reference to the most critical joints required by the fabrication of the filter cage (usually, the butt weld of the cross rings, the resistance cross wire weld between the rings and the longitudinal wires, between the rings and the connection devices between the cage sections and between the longitudinal wires and the top and bottom).

The procedure qualification is made on the basis of the requirements of the European standard, integrated by Wormec with the measurement and the verification of the micro hardness values (whose execution is justified by the extreme severity of thermal cycles applied): after the execution of the visual examination and of the dimensional verification on a sample, a series of pre-production tests is carried out





by an independent third-party Laboratory of mechanical tests: tensile strength (in fact, a shear resistance test), micrographic examination of a sample of each type of the joints, the dimensional verification of the size of the joint sections on the micros (thickness and nugget), micro hardness. The test results are assessed on the basis of the acceptance criteria established under the light of the experience gained over time and agreed with the customers. Some examples regarding the above mentioned tests are shown in the following Figure 1,2,3,4.

Once classified the welding procedures, it is

finally possible to adopt them in the production lines; the actual constancy of the production standards during the entire job is checked by means of production test, carried out and assessed with identical criteria. The WPSs are a significant part of the production documentation and are available by the Technical office and / or the designated Inspection body.

For their geometric and dimensional characteristics, the welded joints allow a limited degree of inspectionability and are therefore poorly suitable to the execution of non destructive tests.



Fig. 1 - Tensile test of a joint made between longitudinal wire and the top.



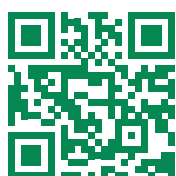
Fig. 2 - Tensile test of a joint made between a longitudinal wire and a ring.



Fig. 3 - Cross section of the weld between a longitudinal wire and a ring..



Fig. 4 - Microhardness measurement on a cross section between a longitudinal wire and a ring.



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